

1 37. (New) A microprocessor comprising:  
2       a register storing a register value corresponding to a threshold  
3       temperature;  
4       a programmable thermal sensor receiving the register value, wherein  
5       the programmable thermal sensor generates a first interrupt signal if a  
6       microprocessor temperature exceeds the threshold temperature  
7       corresponding to the register value;  
8       clock circuitry for providing a clock signal for the microprocessor; and  
9       a processor unit coupled to the clock circuitry, wherein the processor  
10      unit executes instructions to vary the frequency of the clock signal in  
11      response to the first interrupt signal.

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1 38. (New) The microprocessor of claim 37 further comprising:  
2       a fail-safe thermal sensor generating a fail-safe interrupt signal if the  
3       microprocessor temperature exceeds a fail-safe threshold temperature,  
4       wherein the processor unit is halted in response to the fail-safe interrupt  
5       signal.

1 39. (New) The microprocessor of claim 37 wherein the clock circuitry  
2       further comprises a phase locked loop.

1 40. (New) The microprocessor of claim 37 wherein the thermal sensor  
2       comprises:  
3       a current source;  
4       a voltage reference coupled to the current source to provide a  
5       bandgap reference voltage, wherein the bandgap reference voltage is  
6       substantially constant over a range of temperatures;  
7       programmable circuitry providing an output voltage varying with  
8       the microprocessor temperature in accordance with the register value; and  
9       a comparator, wherein the comparator generates the first interrupt  
10      signal if a difference between the output voltage and the bandgap reference  
11      voltage indicates that the threshold temperature has been exceeded.

1 41. (New) The microprocessor of claim 40 wherein the programmable  
2 circuitry further comprises:

3 a transistor coupled to the current source to provide the output  
4 voltage, a gain ratio of the output voltage to a junction voltage of the  
5 transistor controlled by a transistor bias, wherein the junction voltage  
6 varies in accordance with a junction temperature of the transistor, the  
7 junction temperature corresponding to the microprocessor temperature;  
8 a bias circuit providing the transistor bias to control the gain ratio,  
9 wherein the output voltage varies with the microprocessor temperature in  
10 accordance with the register value.

1 42. (New) The microprocessor of claim 41 wherein the bias circuit further  
2 comprises binary weighted resistors.

1 43. (New) A computer system comprising:  
2 an active cooling device;  
3 a microprocessor comprising:  
4 a register storing a register value corresponding to a threshold  
5 temperature;  
6 a programmable thermal sensor receiving the register value,  
7 wherein the programmable thermal sensor generates a first interrupt signal  
8 if a microprocessor temperature exceeds the threshold temperature,  
9 wherein the active cooling device is activated in response to the interrupt  
10 signal.

1 44. (New) The computer system of claim 43 wherein the active cooling  
2 device comprises a fan.

1 45. (New) The computer system of claim 44 further comprising:  
2 clock circuitry for providing a clock signal for the microprocessor,  
3 wherein a frequency of the clock signal is reduced in response to the first  
4 interrupt signal.

1 46. (New) The computer system of claim 45 wherein the clock circuitry  
2 further comprises:  
3       a first clock;  
4       a frequency divider coupled to the first clock to provide the clock  
5 signal, the frequency divider reducing a frequency of the clock signal in  
6 response to the interrupt signal; and  
7       a second clock circuit coupled to provide the clock signal to the  
8 microprocessor.

1 47. (New) The computer system of claim 46 wherein the microprocessor  
2 further comprises:  
3       a processor unit coupled to the second clock circuit, wherein the  
4 processor unit executes instructions to vary the frequency of the clock signal  
5 from the second clock circuit in response to the first interrupt signal.

1 48. (New) The computer system of claim 47 wherein the processor unit  
2 programs the register with another register value corresponding to another  
3 threshold temperature in response to the first interrupt signal.

1 49. (New) A method of controlling a temperature of a microprocessor,  
2 wherein the microprocessor performs the steps of:  
3       a) generating a temperature signal within the microprocessor  
4 indicative of the temperature of the microprocessor;  
5       b) comparing the temperature signal with a first threshold  
6 temperature level within the microprocessor;  
7       c) generating an interrupt signal if the temperature signal  
8 indicates that the first threshold temperature level has been exceeded; and  
9       d) decreasing a microprocessor clock frequency in response to the  
10 interrupt signal.

1 50. (New) The method of claim 49 further comprising the steps of:  
2 e) comparing the temperature signal with a second threshold  
3 temperature level, wherein the second threshold temperature level  
4 represents a fail-safe temperature; and  
5 f) halting the microprocessor, if the temperature signal indicates  
6 that the second threshold temperature level has been exceeded.

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1 51. (New) A method of controlling a temperature of a microprocessor,  
2 wherein the microprocessor performs the steps of:  
3 a) generating a temperature signal within the microprocessor  
4 corresponding to the temperature of the microprocessor;  
5 b) comparing the temperature signal with a first threshold  
6 temperature level within the microprocessor;  
7 c) generating an interrupt signal if the temperature signal  
8 indicates that the first threshold temperature level has been exceeded; and  
9 d) activating an active cooling device to decrease the  
10 microprocessor temperature in response to the interrupt.

1 52. (New) The method of claim 51 wherein the active cooling device is a  
2 fan.

1 53. (New) The method of claim 51 further comprising the steps of:  
2 e) comparing the temperature signal with a second threshold  
3 temperature level, wherein the second threshold temperature level  
4 represents a fail-safe temperature;  
5 f) halting the microprocessor, if the temperature signal indicates  
6 that the second threshold temperature level has been exceeded.

1 54. (New) A method of controlling a frequency of a clock signal which  
2 drives a microprocessor, comprising the steps of:  
3 a) generating a temperature signal <sup>within the microprocessor</sup> corresponding to a  
4 temperature of the microprocessor;

- 5           b) generating a first threshold signal if the temperature signal  
6 indicates that the microprocessor temperature exceeds a first threshold  
7 temperature;  
8           c) generating a second threshold signal if the temperature signal  
9 indicates that the microprocessor temperature exceeds a second threshold  
10 temperature; and  
11          d) varying a frequency of the clock signal in response to at least  
12 one of the first and second threshold signals.

1       55. (New) The method of claim 54 further comprising the step of  
2 programming the first and second predetermined threshold levels within a  
3 programmable register.

1       56. (New) The method of claim 54 wherein step d) further comprises the  
2 step of decreasing the frequency of the clock signal if the first threshold  
3 signal is asserted.

1       57. (New) The method of claim 54 wherein step d) further comprises the  
2 step of increasing the frequency of the clock signal if neither the first  
3 threshold signal nor the second threshold signal are asserted.

1       58. (New) The method of claim 54 wherein step d) further comprises the  
2 step of driving the clock signal at an intermediate frequency if the second  
3 threshold signal is asserted and the first threshold signal is deasserted.

1       59. (New) A microprocessor comprising:  
2           a processor unit;  
3           a clock circuit providing a clock signal to the processor unit, the clock  
4 signal having an associated frequency;  
5           a thermal sensor generating a temperature signal corresponding to a  
6 temperature of the microprocessor;  
7           logic circuitry coupled to the thermal sensor, the logic circuitry  
8 generating a first signal if the temperature signal exceeds a first threshold  
9 level and a second signal if the temperature signal exceeds a second  
10 threshold level; and

11 means for varying the associated frequency of the clock signal in

12 response to at least one of the first and second signals.

- 1 60. (New) The microprocessor of claim 59 further comprising at least one  
2 programmable register for storing a first threshold value corresponding to  
3 the first threshold level.